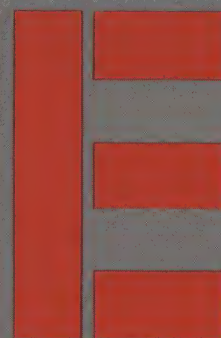


# Potlatch EMSR\*

STRUCTURAL LUMBER

# manual



\*ELECTRO-MECHANICAL  
STRESS-RATED



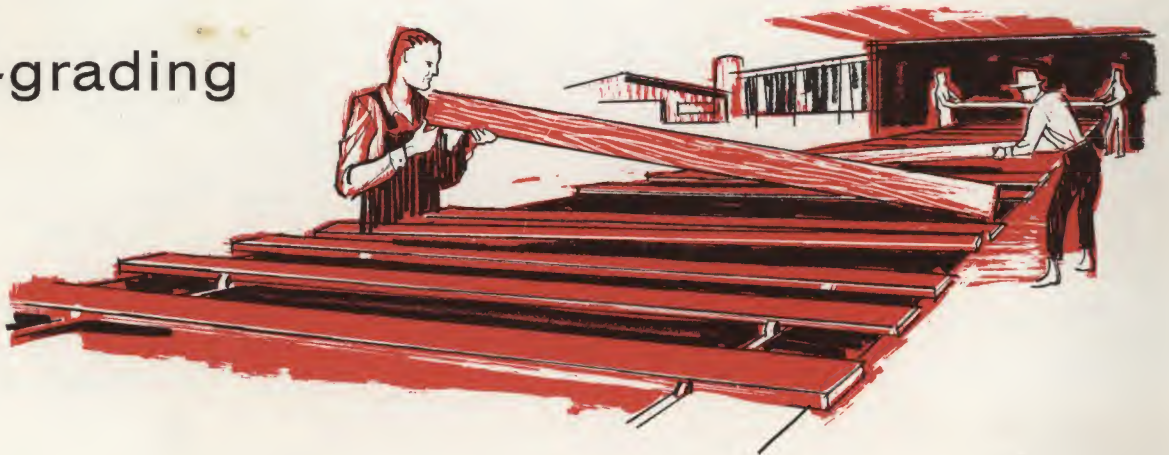
EMSR 8-1-63

# engineered lumber...past and present

For centuries lumber's use in construction was based upon experience, even "hunch," rather than a real understanding of wood's strength. As visual grading practices developed, certain grades and sizes in various species were assigned specific duties in building. Research into wood's strengths tightened up grade uses, and the introduction of visual stress-grading for strength potential gave lumber its beginning as an *engineered* structural material.



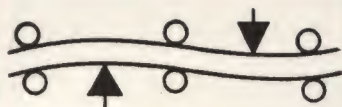
## visual stress-grading



Visual stress-grading takes into careful account those characteristics in manufactured wood which affect its strength. Knots—their type, placement and relationship to other knots—are important factors. So are splits, shake, wane and similar visual characteristics. Tests

of lumber, grade by grade for specific species, have determined safe strength limits. With wide margins of safety built-in, engineered strength values have been assigned to recognized visual stress grades in the stronger framing lumber species.



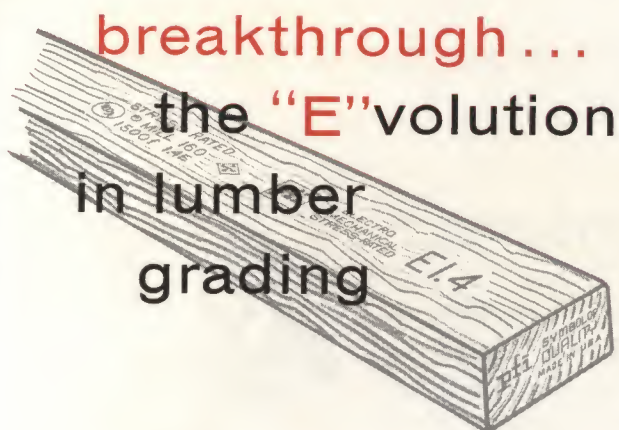


Kiln-dried Potlatch structural lumber is mechanically deflected first one way, then the other, by the electro-mechanical stress-rating machine. The stiffness (Modulus of Elasticity, or "E") is electronically recorded continuously along the length of each piece. As the lumber leaves the measuring section, the electronic computer determines the stiffness of the piece and actuates a stamp that applies both the "E" and the "f" ratings to the lumber.

TAKE A NEW LOOK AT POTLATCH



The CLT-1 (Continuous Lumber Tester) developed by Potlatch in cooperation with Industrial Sciences.



Late in 1962, Potlatch Forests, Inc. introduced to the market structural lumber with its stiffness and strength electro-mechanically rated. The system, described above, rates by stiffness ("E") and related strength ("f"). For the first time, structural lumber is available with principal engineering data marked right on each piece . . . it can be ordered and specified on a basis of certified performance.

## the relationship between stiffness and strength

After thorough, careful research, PFI engineers and wood technologists established that lumber stiffness is related to load-bearing strength. The acceptance of this technological principle by structural engineers has resulted in WPA publishing grading rules which include a special table showing related values (see page 5).

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## everyone profits with EMSR lumber . . .

Perhaps no development in the history of the modern lumber industry—from the manufacturer through the retailer—is as important as high speed, automatic stress-rating for precise strength of structural lumber. But the benefits pass on to designers and builders using lumber products . . . and ultimately to the end consumers, the buyers of end products built of lumber.

### architect and engineer

Designing and specifying with electro-mechanically stress-rated lumber will be greatly simplified. No more ponderous span tables, no variations in spans species by species . . . only five\* specific, precise "E" ratings for each table (see pages 6 and 7).



### retailer and distributor

For wholesaler and retailer, lumber ordering will be simplified by EMSR lumber. Inventories may be reduced from a wide range of grades in various species to a few "E" grades without sacrifice of ability to fill every need.



### builder

Kiln-dried, easy-to-handle, stronger electro-mechanically stress-rated framing members doing bigger jobs will cut building time, materials costs. Easy-to-identify "E" ratings simplify use on the job-site.



### consumer

Electro-mechanically stress-rated lumber in homes and buildings will reduce over-all costs because of increased engineering efficiency. House design may be more open, better planned, and with less lumber doing more and better work.



\*Western Pine Association grade rule provides for 9 grades, but most lumber manufacturers will probably produce less than 9, possibly as few as 3.



# stiffness governs 75% of structural lumber use

Spans for joists, rafters and beams are nearly all set by the stiffness, or "E" value (Modulus of Elasticity), of structural lumber. By far the greatest volume of stress-graded framing lumber today is put to these uses.

The "E" value is the exact measure which Potlatch's EMSR system provides—a rating automatically stamped on each piece of lumber by the electro-mechanical stress-rating machine.

## Strength properties in relation to "E"

Engineering use of lumber requires a complete set of known strength properties. In beam design, for example, "E" (elasticity), "f" (bending strength) or "H" (shear strength) are critical to the measuring of load carrying ability. In roof trusses "t" (tension) and "C<sub>||</sub>" (Compression parallel) are the essential design properties.

Where bearing is important, "C<sub>⊥</sub>" (Compression perpendicular) must be known. The Potlatch Electro-Mechanical Stress Grade stamp displays "E," "f" and the species. Other structural properties are covered by the Western Pine Association grading rules as summarized in the table below.

## ALLOWABLE STRESSES for electro-mechanical stress-rated lumber

From Supplement No. 1, Western Pine Association Grading Rules, 1963.

| "E"<br>modulus of<br>Elasticity<br>millions of<br>psi | "f"<br>Extreme<br>fiber stress<br>in Bending<br>psi | "t" and<br>"C <sub>  </sub> "<br>Tension and<br>compression<br>parallel to<br>grain<br>psi | "C <sub>⊥</sub> "-COMPRESSION<br>PERPENDICULAR TO GRAIN |                                   |                         | "H" SHEAR PARALLEL TO GRAIN |                         |                                   |
|-------------------------------------------------------|-----------------------------------------------------|--------------------------------------------------------------------------------------------|---------------------------------------------------------|-----------------------------------|-------------------------|-----------------------------|-------------------------|-----------------------------------|
|                                                       |                                                     |                                                                                            | D. Fir<br>W. Larch<br>psi                               | West. Hemlock<br>White Fir<br>psi | Engel.<br>Spruce<br>psi | D. Fir<br>W. Larch<br>psi   | West.<br>Hemlock<br>psi | White Fir<br>Engel. Spruce<br>psi |
| 1.0                                                   | 900                                                 | 725                                                                                        | 390                                                     | 365                               | 215                     | 95                          | 80                      | 75                                |
| 1.2                                                   | 1200                                                | 950                                                                                        | 390                                                     | 365                               | 215                     | 95                          | 80                      | 75                                |
| 1.4                                                   | 1500                                                | 1200                                                                                       | 390                                                     | 365                               | 215                     | 110                         | 90                      | 80                                |
| 1.6                                                   | 1800                                                | 1450                                                                                       | 390                                                     | 365                               | 215                     | 120                         | 100                     | 90                                |
| 1.8                                                   | 2100                                                | 1700                                                                                       | 415                                                     | 365                               | 215                     | 135                         | 115                     | 105                               |
| 2.0                                                   | 2400                                                | 1925                                                                                       | 455                                                     | 365                               | 215                     | 135                         | 115                     | 105                               |
| 2.2                                                   | 2700                                                | 2150                                                                                       | 455                                                     | 365                               | 215                     | 135                         | 115                     | 105                               |
| 2.4                                                   | 3000                                                | 2400                                                                                       | 455                                                     | 365                               | 215                     | 135                         | 115                     | 105                               |
| 2.6                                                   | 3300                                                | 2650                                                                                       | 455                                                     | 365                               | 215                     | 135                         | 115                     | 105                               |

EMSR LUMBER SIZES  
(nominal)

2 inches thick by 8 inches wide

4  
6  
10  
12



## Floor Joists

| Nominal Size<br>Inches | Spacing<br>O. C.<br>Inches | 40 PSF Live Load* |                  |                  |                  |                  | 30 PSF Live Load* |                  |                  |                  |                  |
|------------------------|----------------------------|-------------------|------------------|------------------|------------------|------------------|-------------------|------------------|------------------|------------------|------------------|
|                        |                            | E 2.6<br>ft. in.  | E 2.2<br>ft. in. | E 1.8<br>ft. in. | E 1.4<br>ft. in. | E 1.0<br>ft. in. | E 2.6<br>ft. in.  | E 2.2<br>ft. in. | E 1.8<br>ft. in. | E 1.4<br>ft. in. | E 1.0<br>ft. in. |
| 2 x 6                  | 12"                        | 12-0              | 11-3             | 10-6             | 9-8              | 8-8              | 12-11             | 12-2             | 11-4             | 10-5             | 9-4              |
|                        | 16"                        | 10-10             | 10-3             | 9-7              | 8-9              | 7-10             | 11-9              | 11-0             | 10-3             | 9-5              | 8-6              |
|                        | 24"                        | 9-6               | 9-0              | 8-4              | 7-8              | 6-10             | 10-3              | 9-8              | 9-0              | 8-3              | 7-4              |
| 2 x 8                  | 12"                        | 16-0              | 15-4             | 14-5             | 13-3             | 11-10            | 16-11             | 16-3             | 15-5             | 14-3             | 12-9             |
|                        | 16"                        | 14-11             | 14-0             | 13-1             | 12-0             | 10-9             | 15-8              | 15-1             | 14-0             | 12-11            | 11-6             |
|                        | 24"                        | 13-0              | 12-3             | 11-5             | 10-6             | 9-5              | 13-11             | 13-3             | 12-4             | 11-4             | 10-1             |
| 2 x 10                 | 12"                        | 19-1              | 18-3             | 17-5             | 16-4             | 15-0             | 20-2              | 19-4             | 18-5             | 17-3             | 16-0             |
|                        | 16"                        | 17-9              | 17-0             | 16-3             | 15-2             | 13-8             | 18-9              | 18-0             | 17-2             | 16-0             | 14-8             |
|                        | 24"                        | 16-0              | 15-4             | 14-6             | 13-4             | 11-11            | 16-11             | 16-3             | 15-6             | 14-4             | 12-9             |
| 2 x 12                 | 12"                        | 21-11             | 21-0             | 20-1             | 18-11            | 17-5             | 23-2              | 22-3             | 21-4             | 20-0             | 18-4             |
|                        | 16"                        | 20-4              | 19-7             | 18-8             | 17-7             | 16-2             | 21-7              | 20-8             | 19-10            | 18-7             | 17-1             |
|                        | 24"                        | 18-5              | 17-8             | 16-11            | 15-11            | 14-4             | 19-6              | 18-8             | 17-11            | 16-10            | 15-6             |

\*Plus 10 PSF dead load.

For floor joists designed on basis of F.H.A. Minimum Property Standards.  
Requirements: Total design load used for both stress and deflection.  
Deflection = 1/360 span to 15 feet; 1/2" maximum in longer joists.

Table may be used for Douglas Fir, White Fir, Western Larch, Western Hemlock, Engelmann Spruce and Southern Pine.

## Low Slope Roof Joists

| Nominal Size<br>Inches | Spacing<br>Inches | Not Supporting Finished Ceilings* |                  |                  |                  |                  | Supporting Finished Ceilings** |                  |                  |                  |                  |
|------------------------|-------------------|-----------------------------------|------------------|------------------|------------------|------------------|--------------------------------|------------------|------------------|------------------|------------------|
|                        |                   | E 2.6<br>ft. in.                  | E 2.2<br>ft. in. | E 1.8<br>ft. in. | E 1.4<br>ft. in. | E 1.0<br>ft. in. | E 2.6<br>ft. in.               | E 2.2<br>ft. in. | E 1.8<br>ft. in. | E 1.4<br>ft. in. | E 1.0<br>ft. in. |
| 2 x 6                  | 12"               | 16-0                              | 15-4             | 14-5             | 13-3             | 11-10            | 15-4                           | 14-8             | 13-8             | 12-7             | 11-3             |
|                        | 16"               | 14-10                             | 14-0             | 13-1             | 12-0             | 10-9             | 14-1                           | 13-4             | 12-5             | 11-5             | 10-3             |
|                        | 24"               | 12-11                             | 12-3             | 11-5             | 10-6             | 9-1              | 12-4                           | 11-8             | 10-10            | 10-0             | 8-5              |
| 2 x 8                  | 12"               | 20-2                              | 19-4             | 18-4             | 17-3             | 15-10            | 19-4                           | 18-7             | 17-8             | 16-7             | 15-3             |
|                        | 16"               | 18-9                              | 18-0             | 17-1             | 16-1             | 14-8             | 18-0                           | 17-4             | 16-5             | 15-5             | 13-11            |
|                        | 24"               | 16-11                             | 16-3             | 15-5             | 14-4             | 12-4             | 16-9                           | 15-11            | 14-10            | 13-8             | 11-5             |
| 2 x 10                 | 12"               | 24-1                              | 23-1             | 21-11            | 20-7             | 18-10            | 23-2                           | 22-2             | 21-1             | 19-10            | 18-3             |
|                        | 16"               | 22-5                              | 21-5             | 20-5             | 19-2             | 17-8             | 21-6                           | 20-8             | 19-8             | 18-5             | 16-11            |
|                        | 24"               | 20-2                              | 19-5             | 18-5             | 17-4             | 15-7             | 19-5                           | 18-9             | 17-9             | 16-8             | 14-5             |
| 2 x 12                 | 12"               | 27-9                              | 26-8             | 25-4             | 23-10            | 21-10            | 26-8                           | 25-7             | 24-4             | 22-10            | 21-0             |
|                        | 16"               | 25-10                             | 24-9             | 23-7             | 22-2             | 20-4             | 24-10                          | 23-10            | 22-8             | 21-3             | 19-7             |
|                        | 24"               | 23-4                              | 22-4             | 21-3             | 20-0             | 18-4             | 22-5                           | 21-6             | 20-2             | 19-3             | 17-5             |

SLOPE 3 IN 12 OR UNDER

\*20 PSF live load + 10 PSF dead load.

\*\*20 PSF live load + 15 PSF dead load.

For low slope roof joists designed on basis of F.H.A. Minimum Property Standards.  
Requirements: Total design load used for both stress and deflection.  
Deflection = 1/240 span up to 15 feet; 3/4" maximum for longer spans.

Table may be used for Douglas Fir, White Fir, Western Larch, Western Hemlock, Engelmann Spruce and Southern Pine.



# STRESS-RATED LUMBER

## Ceiling Joists

| Nominal Size<br>Inches | Spacing<br>Inches | No Attic Storage* |                  |                  |                  |                  | Limited Attic Storage** |                  |                  |                  |                  |
|------------------------|-------------------|-------------------|------------------|------------------|------------------|------------------|-------------------------|------------------|------------------|------------------|------------------|
|                        |                   | E 2.6<br>ft. in.  | E 2.2<br>ft. in. | E 1.8<br>ft. in. | E 1.4<br>ft. in. | E 1.0<br>ft. in. | E 2.6<br>ft. in.        | E 2.2<br>ft. in. | E 1.8<br>ft. in. | E 1.4<br>ft. in. | E 1.0<br>ft. in. |
| 2 x 4                  | 12"               | 13-6              | 12-10            | 12-0             | 11-0             | 9-10             | 10-9                    | 10-2             | 9-6              | 8-9              | 7-10             |
|                        | 16"               | 12-3              | 11-8             | 10-11            | 10-0             | 9-0              | 9-9                     | 9-3              | 8-8              | 7-11             | 7-1              |
|                        | 24"               | 10-10             | 10-2             | 9-6              | 8-9              | 7-10             | 8-6                     | 8-1              | 7-7              | 7-0              | 6-0              |
| 2 x 6                  | 12"               | 19-0              | 18-4             | 17-4             | 16-3             | 14-11            | 16-0                    | 15-4             | 14-5             | 13-3             | 11-10            |
|                        | 16"               | 17-8              | 16-11            | 16-1             | 15-2             | 13-7             | 14-10                   | 14-0             | 13-1             | 12-0             | 10-9             |
|                        | 24"               | 16-0              | 15-4             | 14-5             | 13-3             | 11-10            | 12-11                   | 12-3             | 11-5             | 10-6             | 9-1              |
| 2 x 8                  | 12"               | 23-11             | 23-0             | 21-10            | 20-6             | 18-10            | 20-2                    | 19-4             | 18-4             | 17-3             | 15-10            |
|                        | 16"               | 22-4              | 21-5             | 20-4             | 19-1             | 17-7             | 18-9                    | 18-0             | 17-1             | 16-1             | 14-8             |
|                        | 24"               | 20-2              | 19-4             | 18-4             | 17-3             | 15-10            | 16-11                   | 16-3             | 15-5             | 14-4             | 12-4             |
| 2 x 10                 | 12"               | 28-7              | 27-5             | 26-1             | 24-6             | 22-6             | 24-1                    | 23-1             | 21-11            | 20-7             | 18-10            |
|                        | 16"               | 26-8              | 25-6             | 24-3             | 22-10            | 21-0             | 22-5                    | 21-5             | 20-5             | 19-2             | 17-8             |
|                        | 24"               | 24-1              | 23-1             | 21-11            | 20-7             | 18-10            | 20-2                    | 19-5             | 18-5             | 17-4             | 15-7             |

\*Slope of roof is 3 in 12 or less. 15 PSF total design load.

\*\*Slope of roof is 3 in 12 or greater. 20 PSF live load + 10 PSF dead load.

For ceiling joists designed on basis of F.H.A. Minimum Property Standards.

Requirements: Total design load used for both stress and deflection.

Deflection = 1/240 span to 15 feet; 3/4" maximum in longer joists.

Table may be used for Douglas Fir, White Fir, Western Larch, Western Hemlock, Engelmann Spruce and Southern Pine.

## Rafters

| Nominal Size<br>Inches | Spacing<br>O. C.<br>Inches | Light Roofing*   |                  |                  |                  |                  | Heavy Roofing**  |                  |                  |                  |                  |
|------------------------|----------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
|                        |                            | E 2.6<br>ft. in. | E 2.2<br>ft. in. | E 1.8<br>ft. in. | E 1.4<br>ft. in. | E 1.0<br>ft. in. | E 2.6<br>ft. in. | E 2.2<br>ft. in. | E 1.8<br>ft. in. | E 1.4<br>ft. in. | E 1.0<br>ft. in. |
| 2 x 4                  | 12"                        | 13-1             | 12-5             | 11-7             | 10-8             | 9-7              | 11-10            | 11-2             | 10-5             | 9-7              | 8-5              |
|                        | 16"                        | 11-11            | 11-3             | 10-6             | 9-8              | 8-6              | 10-9             | 10-2             | 9-6              | 8-9              | 7-4              |
|                        | 24"                        | 10-5             | 9-10             | 9-2              | 8-5              | 6-11             | 9-5              | 8-11             | 8-4              | 7-8              | 6-0              |
| 2 x 6                  | 12"                        | 18-6             | 17-9             | 16-11            | 15-10            | 14-6             | 17-2             | 16-5             | 15-8             | 14-7             | 12-9             |
|                        | 16"                        | 17-3             | 16-7             | 15-9             | 14-8             | 12-11            | 15-10            | 15-4             | 14-5             | 13-3             | 11-1             |
|                        | 24"                        | 15-7             | 14-11            | 14-0             | 12-10            | 10-6             | 14-3             | 13-5             | 12-7             | 11-7             | 9-1              |
| 2 x 8                  | 12"                        | 23-5             | 22-5             | 21-4             | 20-0             | 18-5             | 21-7             | 20-9             | 19-9             | 18-6             | 17-0             |
|                        | 16"                        | 21-9             | 20-11            | 19-10            | 18-8             | 17-2             | 20-1             | 19-4             | 18-4             | 17-3             | 15-0             |
|                        | 24"                        | 19-8             | 18-10            | 17-11            | 16-10            | 14-4             | 18-2             | 17-5             | 16-7             | 15-7             | 12-4             |
| 2 x 10                 | 12"                        | 27-11            | 26-9             | 25-5             | 23-11            | 22-0             | 25-10            | 24-10            | 23-7             | 22-1             | 20-4             |
|                        | 16"                        | 26-0             | 24-11            | 23-8             | 22-3             | 20-5             | 24-0             | 23-1             | 21-11            | 20-7             | 18-11            |
|                        | 24"                        | 23-6             | 22-6             | 21-5             | 20-1             | 18-1             | 21-9             | 20-10            | 19-10            | 18-7             | 15-7             |

SLOPE OVER 3 IN 12

\*15 PSF live load + 7 PSF dead load.

\*\*15 PSF live load + 15 PSF dead load.

For rafters designed on basis of F.H.A. Minimum Property Standards.

Requirements: Total design load used for both stress and deflection.

Deflection = 1/180 span to 15 feet; 1" maximum in longer rafters.

Table may be used for Douglas Fir, White Fir, Western Larch, Western Hemlock, Engelmann Spruce and Southern Pine.



# SPECIAL

Technical assistance for you—in specifying, ordering and using  
Potlatch's EMSR lumber—is just a phone call away. Contact any of  
our offices listed here . . . our entire technical staff is at your service.

## Potlatch EMSR Lumber Technical Service



*For Plywood needs, contact lumber sales office nearest you.*

### POTLATCH FORESTS, INC.

**National Sales Office:** 2590 East Devon Avenue, Des Plaines, Illinois

**General Offices:** Lewiston, Idaho

**Bradley-Southern Division:** Warren, Arkansas



symbol of  
quality  
since 1906

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**312-259-4560** . . . . . **TWX 910-687-3372**

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